introductory GIS section the authors pose the question, "can we teach a computer to read and understand a road map?" This is the basic research question, and the paper that follows describes attempts to do so.

A summary of current efforts to use artificial intelligence and expert systems in map data processing mentions several significant efforts including AUTONAP (a name placement expert system), GENTLE (generalized topographical land-use expert system), and others dealing with generalization, digitizing, urban planning, as well as KBGIS (knowledge-based GIS) described in the *International Journal of GIS* (1987). Most of the information in the introduction of this paper is well known to geographers and cartographers who deal with GIS more regularly than would the electrical engineers who regularly read *Computer*.

After the introduction, the paper takes a more detailed view of the system itself and concludes that it is possible to teach a computer to read a road map (though understanding is not demonstrated). Aside from the CPU (a VAX-11/785), the hardware consists of a scanner and a raster output device for map plotting. Map data are entered in raw raster format at a density of 120 pixels per centimeter. The software components include:

§ The preprocessor takes raw scanned data and separates them into text and graphics layers. Text is processed by optical character recognition techniques, and graphics are passed to the image processor.

§ The improcessor operates on the graphics layer from the preprocessor to extract spatial and structural information. Functions for skeletonization (line-thinning), line following, and symbol identification are the heart of the image system.

§ The query processor analyses queries of the database after they have been entered by the user. Queries must be in a very specific format, thus the query processor operates on translations performed by the natural language processor.

§ The natural language processor is necessary because the query processor format was deemed too complex for users to learn. The natural language processor accepts English commands and parses them to the correct format.

In order to create a response to a query, the system has to perform a number of tasks requiring integration among the processors. As an example, to find the shortest distance (by road) between two cities, the system must be able to:

§ Recognize characters to locate the names.

§ Locate the cities (this is done by locating the names and finding a city symbol near each name).

§ Define an initial window that includes the probable maximum area to search for the shortest path.

§ Discriminate the roads from other map lines.

§ Estimate the length of each road segment and compute the shortest sum of those lengths.

§ Compute the likelihood of a shorter path than that initially found by enlarging the search window and recomputing paths in the larger window if needed.

The authors illustrate the use of the system for three different map reading queries. The system effectively answers all three queries (locating a state, subsetting the roads to those within a single state, and shortest path analysis), and is found to be a useful prototype for paper road map reading.

I was not aware of the journal *Computer* before I was asked to review this paper. An occasional scan of the table of contents would be in order, especially as a reference for articles on cartographic and geographic information processing strategies. If this paper is a fair sample, *Computer* is a good source of fugitive cartographic literature.

Meigs, Philip B. (1990) World Geo-Graphic Atlas. Landmarks of Book Design: First of a Series. *Print*, 44:1 (January/February 1990), pp. 93-101 and pp. 141-142. *reviewed by Richard E. Lindenberg, Kent State University.*

The journal *Print* describes itself as America's graphic design magazine. Although it is uncommon to find an article in it related to maps or geography, the first subject for a series on excellence in book design is Herbert Bayer's 1953 *World Geo-Graphic Atlas*. Philip Meigs, a teacher of design and design history at Virginia Commonwealth University, reviews the atlas and concludes that "It pioneered new ways to present information about the world" (p. 93).

The atlas was commissioned in 1948 by the Container Corporation of America (CCA) to mark its twenty-fifth anniversary in 1953. Bayer had been associated with the influential Bauhaus design school in the 1920's and emigrated to the U.S. in 1946. The CCA had earned a reputation as a patron of design and had given Bayer assignments since 1937. When work began on the atlas in 1948, Bayer expected to spend half of his time for two years on the project. When the final camera-ready copy was shipped to the printer five years

later, he and three assistants were working on it full-time.

Bayer had an interest in natural phenomena as well as maps and diagrams. He saw the atlas not as just an exercise in book design, but also as a chance to rethink the conventional idea of an atlas as simply a collection of maps. He placed the hyphen in the word 'Geo-Graphic' in the title to indicate that the atlas had "in addition to many GEO-graphic maps, many GRAPHIC illustrations of subjects closely related to modern geography" (Bayer 1953, p. 4).

Bayer organized and edited all the material in the atlas and wrote much of the text. He traveled to cartographic centers in the U.S. and Europe in his search for the best graphic methods for mapping and illustrating complex geographic information. The article includes twenty-seven figures reproduced in lush color. Most of these are maps and illustrations from the atlas. Perhaps the most fascinating illustrations are three figures which are sketches of the page layouts originally done in pastel, pencil and colored pencil which are shown with the final pages in juxtaposition.

The author estimates that 4000-5000 separate pieces of art were prepared for the book. The figures and the text are adequate testimonial to Bayer's originality and fastidious attention to detail. His uncompromising attitude resulted in the printing being done partly by Rand McNally and partly by de Agostini of Italy. The story of the design of this atlas is an inspiring account of a significant personal and cartographic achievement.

REFERENCE

Bayer, Herbert (1953) *World Geo-Graphic Atlas.* Container Corporation of America.

cartographic artifacts

BIBLIOGRAPHY

Computer Aided Mapping
February 1984-September 1989, Citations from the Compendex Database. National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. November 1989, 134p, supersedes PB88-8868526. PB90-850439/WNR; price code: PC N01/MF N01.

This bibliography contains citations concerning applications of computer techniques to cartography. Topics include automatic mapping, geographic data bases, computerized photomapping, and descriptions of appropriate algorithms and hardware. Applications for mineral resource exploration and land use analysis are also considered. (This updated bibliography contains 292 citations, 50 of which are new entries to the previous edition.)

ANNOTATED BIBLIOGRAPHY ON TACITICAL MAP DISPLAY SYMBOLOGY.

J.K. Schmidt, Human Engineering Lab., Aberdeen Proving Ground, MD. Aug 89, 120p, AD-A213 257/9/WNR, price code: PC A06/MF A01.

An annotated bibliography on tactical military symbology is provided with corresponding documentation to enhance its use as a reference. The present work is an effort to bring together a rather disparate literature base connected with the portrayal of tactical information on anything from a conventional paper map to an advanced digital map. In addition, pertinent research references concerning specific information encoding techniques are included. Each of the 210 citations presented from the literature contain reference information and an abstract or summary. All listings are indexed by author and subject. Keywords: map symbology; tactical situation display; map display.
Contact: National Technical Information Systems, 5285 Port Royal Road, Springfield, VA 22161.

EOSAT PUBLISHING GIS DIRECTORIES

After surveying almost 100 domestic firms offering remote sensing value-added services, EOSAT has updated the U.S. edition of its Directory of Landsat Related Products and Services. The directory provides the names and addresses of value-added companies, cross referenced by state and application specialties. EOSTAT is offering a new publication that includes information on more than 200 companies worldwide involved in development and use of geographic information systems (GIS). The publication is called Landsat & GIS: A Directory of Geographic Information Systems and Related Products and Services.
Landsat World Update, February 28, 1990.

EOSAT INTRODUCES NEW LINE OF TM DIGITAL PRODUCTS

All Landsat Thematic Mapper (TM) digital products are now offered in an improved computer tape format, known as Fast Format, which reportedly will speed product delivery and reduce customers' computer time. Earth Observation Satellite Co. (EOSAT) will begin delivery of the new Fast Format products March 1, 1990.

The prices of many Landsat products will be raised March 1 — the first increase since 1988–and EOSAT is capitalizing on the timing of the price increase to facilitate the customers' transition